

1 **Patient preferences for different methods of blood pressure**
2 **measurement: is ethnicity relevant?**

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28

29 **Abstract**

30 *Background:* Ambulatory and/or home monitoring are recommended in the UK and North
31 America for the diagnosis of hypertension but little is known about acceptability.

32 *Aim:* To determine the acceptability of different methods of measuring blood pressure to
33 people from different ethnic minority groups.

34 *Design and setting :* Cross sectional study with focus groups in primary care.

35 *Methods:* People with and without hypertension of different ethnicities were assessed for
36 acceptability of clinic, home and ambulatory blood pressure measurement using completion
37 rate, questionnaire and focus groups.

38 *Results:* 770 participants were included comprising white British (n=300), South Asian
39 (n=241) and African Caribbean (n=229). White British participants had significantly higher
40 successful completion rates across all monitoring modalities compared to the other ethnic
41 groups, especially for ambulatory monitoring: white British (277 completed, 92%[89-95%])
42 vs South Asian (171, 71%[65-76%], $p<0.001$ and African Caribbean (188, 82%[77-87%],
43 $p<0.001$) respectively. There were significantly lower acceptability scores for minority ethnic
44 participants across all monitoring methods compared to white British. Focus group results
45 highlighted self-monitoring as most acceptable and ambulatory monitoring least without
46 consistent differences by ethnicity. Clinic monitoring was seen as inconvenient and anxiety
47 provoking but with the advantage of immediate professional input.

48 *Conclusions:* Reduced acceptability and completion rates amongst minority ethnic groups
49 raise important questions for the implementation and interpretation of blood pressure
50 monitoring in general and ambulatory monitoring in particular. Selection of method for
51 blood pressure monitoring should take into account clinical need and patient preference as
52 well as consideration of potential cultural barriers to monitoring.

53

54 ***How this fits in***

55 Ambulatory and home blood pressure monitoring are now recommended in both the UK
56 and North America but little is known about the acceptability of these methods, particularly
57 in ethnic minority groups. This research has shown that home, and particularly ambulatory
58 monitoring are less likely to be completed by ethnic minority individuals, even in a research
59 setting with multi-lingual facilitators. Acceptability of ambulatory monitoring as measured
60 by questionnaire and in qualitative focus groups was lower than either home and clinic
61 measurement. Clinicians' decisions regarding method of blood pressure monitoring should
62 take into account both clinical need and patient preference, particularly for those from
63 minority ethnic populations.

64

65 **Introduction**

66 High blood pressure is a key risk factor for the development of cardiovascular disease.¹
67 Blood pressure has traditionally been measured in the clinic setting, however recent data
68 suggest that out-of-office measurement, particularly ambulatory blood pressure monitoring
69 (ABPM), is more accurate in diagnosing hypertension.^{2 3} These findings have been
70 incorporated in recent international clinical guidelines for the diagnosis of hypertension.⁴
71 ^{5,6,7}

72 Utilisation of out-of-office blood pressure monitoring is likely to be strongly influenced by
73 acceptability to patients. This may vary with both lifestyle and culture, hence the potential
74 impact of ethnicity, which is also associated with cardiovascular prognosis.^{8 9}

75 There have been few studies concerning the acceptability of different methods of blood
76 pressure monitoring. Those that have been undertaken suggest that ABPM is associated
77 with discomfort and sleep disturbance though physicians may be able to make better
78 treatment decisions as a result.¹⁰⁻¹² A Greek Study found that 62% considered ABPM more
79 reliable than home monitoring but that 60% would chose home monitoring for their next
80 evaluation.¹³ None explicitly considered the role of ethnicity in the determination of patient
81 preferences nor presented results in the light of likelihood of completion of a particular
82 method. This mixed methods study aimed to ascertain acceptability of different methods of
83 blood pressure monitoring to people from different ethnic groups and to develop an
84 understanding of the factors underpinning their preferences.

85

86 **Methods**

87 ***Participants***

88 This work formed part of the Blood Pressure in Ethnic Groups Study (BP-Eth) for which
89 detailed methods, including for the qualitative work, have been described previously.^{14 15} In
90 brief, people of White British, South Asian and African Caribbean ethnicities were recruited
91 via their GP to have their blood pressure measured by different methods in 2010-12.
92 Participants were purposefully sampled on the basis of both ethnicity and hypertension

93 status from those responding to an initial survey and agreeing to take part in further
94 research.¹⁴

95 ***Procedures***

96 Participants attended three research clinic appointments and had their blood pressure
97 measured on each occasion. Between clinic visits home blood pressure was measured for
98 one week, and ambulatory blood pressure was measured for 24 hours.^{14 16 17}

99 Completion rates for each method were defined using standard definitions as follows¹⁸:

- 100 - recording of clinic blood pressure at each of the three clinic appointments,
- 101 - 12 home readings on at least 4 days in the measurement week.
- 102 - at least 14 valid day time ambulatory blood pressure readings

103 Previously validated acceptability questionnaires were completed following each method
104 (first occasion for clinic readings) – see table 2.¹¹

105 A convenience sample of participants willing to take part in an embedded focus group study,
106 was purposefully chosen to represent men and women as well as the three ethnic groups (ie
107 six groups, one each for men and women of each ethnicity).^{19 20} Experiences and views of all
108 three blood pressure measurement methods both within the study and in their general
109 experience were discussed. The topic guide is included in the appendix. Focus groups were
110 undertaken contemporaneously and independently before the quantitative analysis was
111 complete. We did not set out to seek data saturation as our aim was to gain information to
112 explain and extend the quantitative findings.

113

114 ***Analysis***

115 Outcome data for the quantitative analysis comprised:

- 116 a) Completion rates for each method
- 117 b) Acceptability using a previously validated questionnaire.¹¹
- 118 c) A rank order of preference for each method. This included both doctor and nurse
119 measured clinic blood pressure in order to be comparable with other studies using the same
120 ranking system.

A three level hierarchical model was developed, (level 1 acceptability score, level 2 patient and level 3 general practice). The model had a pre-specified set of covariates: ethnicity, age, sex, marital status, index of multiple deprivation (IMD 2007), employment status, body mass index (BMI), smoking status, alcohol consumption, cholesterol, cardiovascular disease, chronic kidney disease, diabetes and hypertension. The study hypothesis was addressed by a two-way interaction term between method of measurement and ethnicity.²¹ All analyses were undertaken in Stata (release 12).

The study was powered on the ability to detect differences in blood pressure between the different ethnic groups rather than acceptability but retained the power of 80% at a 5% 2-sided significance to detect a 10% difference in completion rates between ethnic groups assuming there were at least 219 participants in each group and that the rate was 80% on one group and 70% in the other.

Focus group transcripts were analysed thematically then triangulated and coded.²² Themes relating to the acceptability of the three modalities were extracted and a framework developed showing how they related to each other. Methodological triangulation was undertaken comparing the focus group results with those from the quantitative analysis.²³

Results

Participant Characteristics

Data were available from 770 (94%) participants (481 (63%) known to be hypertensive) from the three ethnic groups under consideration (Table 1). Mean age was 59 years, 51% were female and mean BMI was just under 30kg/m².

Blood pressure monitoring completion rates

White British participants had the highest completion rates across all methods of measurement (Table 1). South Asian participants were significantly less likely to complete ABPM (171, 71% [CI 65, 76%]) than either African Caribbean (188, 82% [CI 77, 87%], $p=0.004$ or White British 92% [293, CI 89, 95%], $p<0.001$). Both ethnic minority groups were less likely to complete home monitoring than White British (Table 1).

Acceptability

South Asian and African Caribbean groups gave lower acceptability for each method of blood pressure measurement than White British people but these were significant only for ABPM for South Asians compared to white British))(Table 2, Figure 1). Overall ambulatory monitoring was less acceptable than either clinic or home measurement with differences in the questionnaire items regarding disturbances of activities, sleep, work and general discomfort (Appendix eTable 1, Figure 1).

Ranking

Ranking by method of measurement also showed ambulatory monitoring to be significantly less popular than the other methods. Self-monitoring was ranked highest with a small but significant difference over clinic measurements (Table 3). There was little difference in the order by which methods were ranked between ethnic groups.

Focus Group Results

The characteristics of the 37 focus group participants are summarised in appendix eTable 2. The overall thematic framework developed in the analysis linked emergent themes to each modality of measurement (Figure 3). Quotes relating to each theme are labelled by ethnic group, sex and participant number.

Office Monitoring

The presence of a clinician, increased anxiety and inconvenience were the key themes to emerge regarding the acceptability of office monitoring (figure 3). Whilst similar numbers of statements regarding preferences for office monitoring were made in all of the focus groups, ethnic minority groups had more negative views.

Presence of a clinician

Participants from four out of six focus groups felt that a key benefit arising from office monitoring was the presence of a clinician whilst measurements were being made. This was due to a perceived improvement in the accuracy of readings resulting from a professional

176 executing the process and their immediate interpretation of results, thus enabling any
177 necessary action to be promptly taken.

178 *"... the purpose of the exercise was to get as accurate information as possible....so when it*
179 *was done by the professional, well, I thought that was going to be perfect "* (AC,M,5)

180 *"Well, I think the fact that you're in the right place and that you're not the expert....and if*
181 *there are any issues.....well at least there is some experience and expertise around"*
182 (SA, M, 4)

183

184 **Anxiety and inconvenience**

185 Every focus group apart from white British men mentioned anxiety caused by the office
186 environment as an issue leading to falsely high readings. Some white British women found
187 that the cuff that was used in the study for clinic readings sometimes caused bruising and
188 members of the African Caribbean male group found attending the clinic inconvenient.

189

190 *"When I was taking it myself I was quite calm...but there's something about coming up here*
191 *that I don't...I don't cut it, I don't like coming up to hospital and surgery so I get all wound*
192 *up"* (AC, F, 3)

193

194 *"...The one you did yourself was much better, it saves you coming to the doctors....it's much*
195 *easier to do at home than coming in"* (AC, M, 3)

196

197 **Home monitoring**

198 Home monitoring was popular and preferred by all three ethnic groups, particularly African-
199 Caribbean. Key positive themes emerging were the ease of home monitoring, its
200 accuracy/efficiency and increased patient involvement. Conversely, some expressed
201 concern about the need for timing and discipline whilst others doubted their own
202 competence in executing the method.

203

204 ***Ease of home monitoring***

205 All six focus groups reported that home monitoring was straightforward both in terms of
206 executing the process and fitting it around daily activities. The two South Asian groups in
207 particular found it very convenient.

208 *"I mean, taking it, is a doddle. It's extremely easy to do when you know what you're doing"*
209 (WB,F,7)

210

211 ***Accuracy and efficiency***

212 Self-monitoring was also seen as offering improved efficiency over other methods due to
213 the increased number of readings resulting from a relatively low input of time. This was
214 considered to improve accuracy, as was the "relaxing" nature of the home setting which was
215 felt to enable a better representation of blood pressure.

216 *"I think that the GP should be able to decide better about the medication because I think*
217 *that when you are at home you are more calm and relaxed, so your blood pressure reading*
218 *should be alright"* (SA, F, 1)

219

220 ***Increased patient involvement***

221 Self-monitoring was considered to promote patient involvement in the management of
222 blood pressure.

223 *"....I didn't mind having it done, in fact I started to get more interested in my blood pressure"*
224 (AC,F,6)

225

226 However, the white British female group felt that they needed explicit "permission" from
227 their doctor in order to self-monitor:

228 *"...Doctors don't like people taking their blood pressure all the time.....and I do think that*
229 *there is resistance within doctors to people to keep on taking their own blood pressure*
230 *....there is that idea that "leave it to the experts.... "" (WB, F, 1)*

231

232 ***Timing and discipline***

233 Remembering to home monitor was an issue raised by all ethnic groups, particularly for
234 those doing shift work. This related to the guideline stipulation to take both morning and
235 evening measurements between six and twelve o'clock.²⁴

236 *"....at home because of the time limit that we were given, when we could take the morning*
237 *and the evening, being a part time worker, working shift work, I was very limited.... to when I*
238 *could do mine" (WB, F, 6)*

239

240 ***Anxiety and expertise***

241 There were concerns within all ethnic groups regarding accuracy of the equipment and lack
242 of experience in executing the method:

243 *".....the question when you've got your own monitor, is, is it as good as the one that the GP's*
244 *got? you think.... well, am I doing it right?" (WB,F,3)*

245

246 Others felt that home monitoring was anxiety provoking due to the fear of a high reading
247 and its associated health implications:

248 *"But when I got home and I thought, oh, you know, I've got to take my blood pressure I*
249 *suddenly I had a huge panic attack..... and then of course, when I took it, it was high...I mean*
250 *it was bound to be, wasn't it?" (WB,F,7)*

251 *"the first one I had was 206mmHg – I thought I was going to die" (AC, M, 6)*

252

253 **Ambulatory Monitoring**

254 ABPM was valued for its accuracy by all ethnic groups. However, this was tempered by its
255 impact on daily activities and sleep, along with the embarrassment caused by others being
256 aware of its presence.

257 ***Accurate and influences decision making***

258 Ambulatory monitoring was widely seen to improve accuracy, thereby enabling better
259 clinical decisions to be made about blood pressure:

260 *"I think that coming to your GP etc. isn't a problem: but they're just random snapshots so I'm*
261 *more convinced about the 24 hour one taking an average" (WB, M, 4)*

262 However, whilst only a minority supported its use on multiple occasions a number of
263 participants said that they were happy to do it as a "one off":

264 *"if we had to do it on a regular basis then I would find that really uncomfortable...but for the*
265 *one day I didn't mind" (AC,F,4)*

266

267 ***Influence of daily activities***

268 White British participants particularly commented that ABPM measurements depended on
269 what they had been doing on the measurement day. If this were not typical of their usual
270 routine then some thought that the resulting readings might not represent their "true"
271 blood pressure.

272 *".....but at the time I'd only just been made redundant so it was just a case of saying "this*
273 *really isn't a normal day".....so it would be interesting to see what the results would be....(If I*
274 *had been more active)" (WB, M, 4)*

275

276 ***Disruption of sleep and other activities***

277 More than twice as many negative than positive comments were made regarding
278 ambulatory monitoring. A key issue here was disruption to sleep and other activities due to
279 discomfort. Such views were held regardless of ethnicity.

280 *"I didn't get much sleep (on the day of the ABPM) because as soon as it started it woke me*
281 *up" (AC, F, 3)*

282

283 ***Embarrassment, medicalisation and anxiety***

284 The fact that monitoring occurred throughout the day and was obvious to others, hence
285 resulting in potential embarrassment, were particular issues reported by South Asian and
286 African-Caribbean participants:

287 *"if the design was a bit more discreet and a little bit more user friendly then maybe we*
288 *would have had a different experience but as it stands now you know, it is intrusive"*
289 *(SA, M, 4)*

290 *".....what I did mind was walking along the road and then I would get the warning and have*
291 *to stop.....and people were watching me.....and it was so embarrassing" (AC,F, 6)*

292

293 Both ethnic minority groups commented on the anxiety that ambulatory monitoring
294 brought on and the impression given to others of having a medical problem:

295 *"'cos I live with my in-laws I had to hide it from them 'cos I didn't want them to get worried*
296 *that there was something wrong" (SA, F, 5)*

297

298 **Discussion**

299 ***Summary***

300 This study has evaluated acceptability data from a large group of people drawn from white
301 British and two major ethnic minority groups and has shown that whilst all methods of
302 blood pressure monitoring were broadly acceptable to people from all three ethnic groups,
303 ambulatory monitoring was less favoured. Furthermore, South Asian and African Caribbean
304 participants found all types of monitoring significantly less acceptable than those from the
305 white British group and, this was reflected in lower completion rates, particularly for the
306 South Asian group. Given UK and international guidelines on the use of ambulatory

monitoring for the diagnosis of hypertension, a 20% difference in completion of such monitoring could have a significant impact on the quality of care across ethnic communities.^{6 25} Conversely, self-monitoring proved popular with all participants. The consistency of results across quantitative and qualitative methodologies suggests that genuine differences exist in acceptability between methods and between ethnic groups.

Strengths and Limitations

To our knowledge, this is the first study to gain detailed information on the acceptability and performance of different methods of blood pressure monitoring in a large multi-ethnic population. This is important because such monitoring is such a common aspect of clinical management, particularly in primary care. The results are strengthened by using a combination of methods.

Participants were recruited from one area of the UK and homogeneity within ethnic groups has been assumed. This might potentially limit generalisability in that there may be differences within the ethnic categories used in this study. However, the uniformity of responses from multiple methods by those of different ethnic groups suggests that this is unlikely to have affected the headline results.

Recruitment relied on purposive sampling of a pool of volunteers to ensure that all three minority ethnic groups were represented and as were those with and without a diagnosis of hypertension. Respondents from ethnic minority groups were younger and this was taken into account in the statistical analysis.²⁶ More participants had a previous diagnosis of hypertension than not, although this might be expected to lead to better rather than worse acceptability given prior exposure.

Comparison with existing literature

In common with previous studies, this work has shown that ambulatory monitoring is less acceptable than other methods of blood pressure measurement.¹¹⁻¹³ Compared to the previous work in the UK, Greece and in a largely white area of the US, the current study has extended these findings to African Caribbean and South Asian groups. To our knowledge,

the reduced acceptability of ambulatory monitoring by minority ethnic groups, and particularly South Asians has not been reported before.

Whilst relative preferences for modality of blood pressure monitoring were broadly consistent between ethnic groups, South Asian and African Caribbean participants rated all modalities of blood pressure monitoring less favourably than their white British counterparts albeit only approaching significance for the South Asian group for ABPM. This fits with data suggesting that minority ethnic groups rate various aspects of primary care less favourably than white British.²⁷

Respondents considered ABPM was acceptable when there was a clear medical need, as it resulted in improved accuracy, reinforcing findings from the US and Greece.^{12 13} The most commonly reported issue with ABPM in the focus groups and questionnaire responses was disturbance of sleep: hence, use of daytime ambulatory monitoring alone might improve this.

The positive views on home monitoring expressed here reinforce similar findings from recent trials.^{28 29} However, this method has been shown to have only moderate diagnostic agreement when tested against the reference of ABPM.² Nonetheless, longitudinal studies have shown improved prognostic power from home compared to clinic readings and recent Japanese guidelines have incorporated self-monitoring for both diagnosis and ongoing management.^{30 31}

Implications for Practice

Around 20% fewer South Asian individuals completed the minimum acceptable number of ambulatory measurements compared with white British people, despite multilingual research team, availability of translated research materials and probably longer explanations than might occur in daily practice. This seems from the Focus Groups to have been at least in part because of issues of embarrassment compounded by questions from extended family that may be more relevant to minority ethnic groups. Serious consideration as to how this problem can be addressed is needed if the benefits of accurate monitoring and particularly diagnosis are to be extended to all. An important issue is the current often bulky and noisy ambulatory monitoring technology. New methods of indirect blood pressure

monitoring which do not require inflating cuffs are under development and may address this.³²

Greater use of home monitoring in the management of hypertension seems likely to be supported by people of all ethnicities. In the meantime, clinic monitoring currently retains a significant role in the management of hypertension despite its inaccuracy.^{5 25} Clinicians' decisions regarding method of blood pressure monitoring for an individual should take into account both clinical need and patient preference: however a discussion of lifestyle and cultural factors, particularly with those from minority ethnic groups, may be required in order to maximise the quality of care provided.³³ In blood pressure monitoring, ethnicity is relevant.

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Ethics

A favourable ethical opinion was obtained from the Birmingham and Black Country Ethics committee reference 09/H1202/114.

407 **Contributorship**

408 RJM and UM had the original idea for this work and gained funding in collaboration with PG,
409 JM, SG, JC and MM. GH, AJ, CS and SW collected the data in collaboration with colleagues in
410 the PCRN-CE. SW, SG, RJM, SH and MM did the analyses. SW, RJM and SG wrote the first
411 draft of this paper and all authors subsequently assisted in redrafting and have approved
412 the final version. RJM will act as guarantor and affirms that the manuscript is an honest,
413 accurate, and transparent account of the study being reported; that no important aspects of
414 the study have been omitted; and that any discrepancies from the study as planned have
415 been explained.

416 **Competing Interests**

417 RJM has received research support in terms of blood pressure monitors from Omron and
418 Lloyds Pharmacies and funding to attend and speak at the Japanese Society of
419 Hypertension. All authors have completed the Unified Competing Interests Statement.

420 **Data Sharing**

421 Requests for data sharing to the corresponding author.

422 .

423

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Tables

Table 1 Demographic Characteristics for those taking part in the validation study

Characteristic	Total N (%) unless otherwise stated	White British N (%) unless otherwise stated	South Asian N (%) unless otherwise stated	African Caribbean N (%) unless otherwise stated
Participants	770	300 (39)	241 (31)	229 (30)
Male	374 (49)	154 (51)	132 (55)	88 (38)
Mean Age (SD)	59 (9.6)	62 (8.7)	56 (9.4)	57 (9.7)
Mean Body Mass Index (SD)	29.7 (5.6)	30.1 (5.8)	28.4 (4.3)	30.5 (6.3)
Previous history of hypertension	481 (63)	184 (61)	144 (60)	153 (67)
Previous history Coronary Heart Disease or Stroke	128 (17)	64 (21)	33(14)	31(14)
Previous History Chronic Kidney Disease	60 (8)	22 (7)	14 (6)	24 (10)
Successfully Completed Clinic Monitoring (all three occasions) +	710 (92, 90-94%)	287 (96, 93-98%)	214 (89, 84-92%)	209 (91, 87-94%)
Provided Clinic Acceptability Questionnaire*+	769 (100, 99-100%)	300 (100, 99-100%)	240 (100, 98-100%)	229 (100, 98-100%)
Successfully Completed Home Monitoring (at least 12 readings) +	715 (93, 91-95%)	292 (97, 95-99%)	220 (91, 87-94%)	203 (89, 84-92%)
Provided Home Acceptability Questionnaire+	727 (94, 93-96%)	293 (98, 95-99%)	223 (93, 89-95%)	211 (92, 88-95%)
Successfully Completed Ambulatory Monitoring (at least 14 daytime readings) +	636 (83, 80-85%)	277 (92, 89-95%)	171 (71, 65-76%)	188 (82, 77-87%)
Provided Ambulatory Acceptability Questionnaire+	715 (93, 91-95%)	292 (97, 95-99%)	213 (88, 84-92%)	210 (92, 87-95%)

* Note, all participants provided acceptability scores based on the first day of clinic readings

+ percentage and 95% confidence intervals given below in each case

Table 2 Mean acceptability scores:

		White British	South Asian	Afro-Caribbean
ABPM	Raw	2.8 (2.7 to 2.9)	3.1 (2.9 to 3.2)	2.9 (2.8 to 3.1)
	Adjusted	2.7 (2.6 to 2.9)	3.1 (2.9 to 3.2)	3.0 (2.8 to 3.1)
Clinic	Raw	2.3 (2.2 to 2.4)	2.4 (2.3 to 2.5)	2.5 (2.4 to 2.6)
	Adjusted	2.2 (2.1 to 2.4)	2.4 (2.3 to 2.6)	2.5 (2.4 to 2.6)
Self	Raw	2.0 (1.9 to 2.1)	2.2 (2.1 to 2.3)	2.3 (2.2 to 2.4)
	Adjusted	1.9 (1.8 to 2.1)	2.2 (2.1 to 2.4)	2.3 (2.1 to 2.4)

Figures are mean (95% CI).

Scores are composite of 13 items (see appendix table 1 for individual scores)

Lower scores reflect better acceptability

Table 3 Preference ranking

	ABPM	Self	Nurse*	Doctor*
Mean (95% CI)	0.5 (0.5 to 0.6)	2.2 (2.1 to 2.3)	1.8 (1.8 to 1.9)	1.5 (1.4 to 1.6)
Median (IQR)	0.0 (0.0 to 0.0)	3.00 (3.0 to 3.0)	2.00 (2.0 to 2.0)	1.00 (1.0 to 1.0)

Higher numbers indicate more favourable ranking

*Patients were asked to rank clinic measurements by both nurse and doctor although this study only included measurements by a nurse / research facilitator

P<0.001 for each comparison, (Friedman's ANOVA followed by pairwise post hoc test).

Patient preferences for different methods of blood pressure measurement: is ethnicity relevant?

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Abstract

Background: Ambulatory and/or home monitoring are recommended in the UK and North America for the diagnosis of hypertension but little is known about acceptability.

Aim: To determine the acceptability of different methods of measuring blood pressure to people from different ethnic minority groups.

Design and setting : Cross sectional study with focus groups in primary care.

Methods: People with and without hypertension of different ethnicities were assessed for acceptability of clinic, home and ambulatory blood pressure measurement using completion rate, questionnaire and focus groups.

Results: 770 participants were included comprising white British (n=300), South Asian (n=241) and African Caribbean (n=229). White British participants had significantly higher successful completion rates across all monitoring modalities compared to the other ethnic groups, especially for ambulatory monitoring: white British (277 completed, 92%[89-95%]) vs South Asian (171, 71%[65-76%], $p<0.001$ and African Caribbean (188, 82%[77-87%], $p<0.001$) respectively. There were significantly lower acceptability scores for minority ethnic participants across all monitoring methods compared to white British. Focus group results highlighted self-monitoring as most acceptable and ambulatory monitoring least without consistent differences by ethnicity. Clinic monitoring was seen as inconvenient and anxiety provoking but with the advantage of immediate professional input.

Conclusions: Reduced acceptability and completion rates amongst minority ethnic groups raise important questions for the implementation and interpretation of blood pressure monitoring in general and ambulatory monitoring in particular. Selection of method for blood pressure monitoring should take into account clinical need and patient preference as well as consideration of potential cultural barriers to monitoring.

How this fits in

Ambulatory and home blood pressure monitoring are now recommended in both the UK and North America but little is known about the acceptability of these methods, particularly in ethnic minority groups. This research has shown that home, and particularly ambulatory monitoring are less likely to be completed by ethnic minority individuals, even in a research setting with multi-lingual facilitators. Acceptability of ambulatory monitoring as measured by questionnaire and in qualitative focus groups was lower than either home and clinic measurement. Clinicians' decisions regarding method of blood pressure monitoring should take into account both clinical need and patient preference, particularly for those from minority ethnic populations.

Introduction

High blood pressure is a key risk factor for the development of cardiovascular disease.¹ Blood pressure has traditionally been measured in the clinic setting, however recent data suggest that out-of-office measurement, particularly ambulatory blood pressure monitoring (ABPM), is more accurate in diagnosing hypertension.^{2 3} These findings have been incorporated in recent international clinical guidelines for the diagnosis of hypertension.^{4 5,6,7}

Utilisation of out-of-office blood pressure monitoring is likely to be strongly influenced by acceptability to patients. This may vary with both lifestyle and culture, hence the potential impact of ethnicity, which is also associated with cardiovascular prognosis.^{8 9}

There have been few studies concerning the acceptability of different methods of blood pressure monitoring. Those that have been undertaken suggest that ABPM is associated with discomfort and sleep disturbance though physicians may be able to make better treatment decisions as a result.¹⁰⁻¹² A Greek Study found that 62% considered ABPM more reliable than home monitoring but that 60% would chose home monitoring for their next evaluation.¹³ None explicitly considered the role of ethnicity in the determination of patient preferences nor presented results in the light of likelihood of completion of a particular method. This mixed methods study aimed to ascertain acceptability of different methods of blood pressure monitoring to people from different ethnic groups and to develop an understanding of the factors underpinning their preferences.

Methods

Participants

This work formed part of the Blood Pressure in Ethnic Groups Study (BP-Eth) for which detailed methods, including for the qualitative work, have been described previously.^{14 15} In brief, people of White British, South Asian and African Caribbean ethnicities were recruited via their GP to have their blood pressure measured by different methods in 2010-12. Participants were purposefully sampled on the basis of both ethnicity and hypertension

status from those responding to an initial survey and agreeing to take part in further research.¹⁴

Procedures

Participants attended three research clinic appointments and had their blood pressure measured on each occasion. Between clinic visits home blood pressure was measured for one week, and ambulatory blood pressure was measured for 24 hours.^{14 16 17}

Completion rates for each method were defined using standard definitions as follows¹⁸:

- recording of clinic blood pressure at each of the three clinic appointments,
- 12 home readings on at least 4 days in the measurement week.
- at least 14 valid day time ambulatory blood pressure readings

Previously validated acceptability questionnaires were completed following each method (first occasion for clinic readings) – see table 2.¹¹

A convenience sample of participants willing to take part in an embedded focus group study, was purposefully chosen to represent men and women as well as the three ethnic groups (ie six groups, one each for men and women of each ethnicity).^{19 20} Experiences and views of all three blood pressure measurement methods both within the study and in their general experience were discussed. The topic guide is included in the appendix. Focus groups were undertaken contemporaneously and independently before the quantitative analysis was complete. We did not set out to seek data saturation as our aim was to gain information to explain and extend the quantitative findings.

Analysis

Outcome data for the quantitative analysis comprised:

- a) Completion rates for each method
- b) Acceptability using a previously validated questionnaire.¹¹
- c) A rank order of preference for each method. This included both doctor and nurse measured clinic blood pressure in order to be comparable with other studies using the same ranking system.

A three level hierarchical model was developed, (level 1 acceptability score, level 2 patient and level 3 general practice). The model had a pre-specified set of covariates: ethnicity, age, sex, marital status, index of multiple deprivation (IMD 2007), employment status, body mass index (BMI), smoking status, alcohol consumption, cholesterol, cardiovascular disease, chronic kidney disease, diabetes and hypertension. The study hypothesis was addressed by a two-way interaction term between method of measurement and ethnicity.²¹ All analyses were undertaken in Stata (release 12).

The study was powered on the ability to detect differences in blood pressure between the different ethnic groups rather than acceptability but retained the power of 80% at a 5% 2-sided significance to detect a 10% difference in completion rates between ethnic groups assuming there were at least 219 participants in each group and that the rate was 80% on one group and 70% in the other.

Focus group transcripts were analysed thematically then triangulated and coded.²² Themes relating to the acceptability of the three modalities were extracted and a framework developed showing how they related to each other. Methodological triangulation was undertaken comparing the focus group results with those from the quantitative analysis.²³

Results

Participant Characteristics

Data were available from 770 (94%) participants (481 (63%) known to be hypertensive) from the three ethnic groups under consideration (Table 1). Mean age was 59 years, 51% were female and mean BMI was just under 30kg/m².

Blood pressure monitoring completion rates

White British participants had the highest completion rates across all methods of measurement (Table 1). South Asian participants were significantly less likely to complete ABPM (171, 71% [CI 65, 76%]) than either African Caribbean (188, 82% [CI 77, 87%], $p=0.004$ or White British 92% [293, CI 89, 95%], $p<0.001$). Both ethnic minority groups were less likely to complete home monitoring than White British (Table 1).

Acceptability

South Asian and African Caribbean groups gave lower acceptability for each method of blood pressure measurement than White British people but these were significant only for ABPM for South Asians compared to white British))(Table 2, Figure 1). Overall ambulatory monitoring was less acceptable than either clinic or home measurement with differences in the questionnaire items regarding disturbances of activities, sleep, work and general discomfort (Appendix eTable 1, Figure 1).

Ranking

Ranking by method of measurement also showed ambulatory monitoring to be significantly less popular than the other methods. Self-monitoring was ranked highest with a small but significant difference over clinic measurements (Table 3). There was little difference in the order by which methods were ranked between ethnic groups.

Focus Group Results

The characteristics of the 37 focus group participants are summarised in appendix eTable 2. The overall thematic framework developed in the analysis linked emergent themes to each modality of measurement (Figure 3). Quotes relating to each theme are labelled by ethnic group, sex and participant number.

Office Monitoring

The presence of a clinician, increased anxiety and inconvenience were the key themes to emerge regarding the acceptability of office monitoring (figure 3). Whilst similar numbers of statements regarding preferences for office monitoring were made in all of the focus groups, ethnic minority groups had more negative views.

Presence of a clinician

Participants from four out of six focus groups felt that a key benefit arising from office monitoring was the presence of a clinician whilst measurements were being made. This was due to a perceived improvement in the accuracy of readings resulting from a professional

executing the process and their immediate interpretation of results, thus enabling any necessary action to be promptly taken.

“... the purpose of the exercise was to get as accurate information as possible....so when it was done by the professional, well, I thought that was going to be perfect ” (AC,M,5)

“Well, I think the fact that you’re in the right place and that you’re not the expert....and if there are any issues.....well at least there is some experience and expertise around”
(SA, M, 4)

Anxiety and inconvenience

Every focus group apart from white British men mentioned anxiety caused by the office environment as an issue leading to falsely high readings. Some white British women found that the cuff that was used in the study for clinic readings sometimes caused bruising and members of the African Caribbean male group found attending the clinic inconvenient.

“When I was taking it myself I was quite calm...but there’s something about coming up here that I don’t...I don’t cut it, I don’t like coming up to hospital and surgery so I get all wound up” (AC, F, 3)

“...The one you did yourself was much better, it saves you coming to the doctors....it’s much easier to do at home than coming in” (AC, M, 3)

Home monitoring

Home monitoring was popular and preferred by all three ethnic groups, particularly African-Caribbean. Key positive themes emerging were the ease of home monitoring, its accuracy/efficiency and increased patient involvement. Conversely, some expressed concern about the need for timing and discipline whilst others doubted their own competence in executing the method.

Ease of home monitoring

All six focus groups reported that home monitoring was straightforward both in terms of executing the process and fitting it around daily activities. The two South Asian groups in particular found it very convenient.

"I mean, taking it, is a doddle. It's extremely easy to do when you know what you're doing"
(WB,F,7)

Accuracy and efficiency

Self-monitoring was also seen as offering improved efficiency over other methods due to the increased number of readings resulting from a relatively low input of time. This was considered to improve accuracy, as was the "relaxing" nature of the home setting which was felt to enable a better representation of blood pressure.

"I think that the GP should be able to decide better about the medication because I think that when you are at home you are more calm and relaxed, so your blood pressure reading should be alright" (SA, F, 1)

Increased patient involvement

Self-monitoring was considered to promote patient involvement in the management of blood pressure.

"....I didn't mind having it done, in fact I started to get more interested in my blood pressure"
(AC,F,6)

However, the white British female group felt that they needed explicit "permission" from their doctor in order to self-monitor:

“...Doctors don’t like people taking their blood pressure all the time.....and I do think that there is resistance within doctors to people to keep on taking their own blood pressurethere is that idea that “leave it to the experts.... ”” (WB, F, 1)

Timing and discipline

Remembering to home monitor was an issue raised by all ethnic groups, particularly for those doing shift work. This related to the guideline stipulation to take both morning and evening measurements between six and twelve o’clock.²⁴

“....at home because of the time limit that we were given, when we could take the morning and the evening, being a part time worker, working shift work, I was very limited.... to when I could do mine” (WB, F, 6)

Anxiety and expertise

There were concerns within all ethnic groups regarding accuracy of the equipment and lack of experience in executing the method:

“.....the question when you’ve got your own monitor, is, is it as good as the one that the GP’s got? you think.... well, am I doing it right?” (WB,F,3)

Others felt that home monitoring was anxiety provoking due to the fear of a high reading and its associated health implications:

“But when I got home and I thought, oh, you know, I’ve got to take my blood pressure I suddenly I had a huge panic attack..... and then of course, when I took it, it was high...I mean it was bound to be, wasn’t it?” (WB,F,7)

“the first one I had was 206mmHg – I thought I was going to die” (AC, M, 6)

Ambulatory Monitoring

ABPM was valued for its accuracy by all ethnic groups. However, this was tempered by its impact on daily activities and sleep, along with the embarrassment caused by others being aware of its presence.

Accurate and influences decision making

Ambulatory monitoring was widely seen to improve accuracy, thereby enabling better clinical decisions to be made about blood pressure:

"I think that coming to your GP etc. isn't a problem: but they're just random snapshots so I'm more convinced about the 24 hour one taking an average" (WB, M, 4)

However, whilst only a minority supported its use on multiple occasions a number of participants said that they were happy to do it as a "one off":

"if we had to do it on a regular basis then I would find that really uncomfortable...but for the one day I didn't mind" (AC,F,4)

Influence of daily activities

White British participants particularly commented that ABPM measurements depended on what they had been doing on the measurement day. If this were not typical of their usual routine then some thought that the resulting readings might not represent their "true" blood pressure.

".....but at the time I'd only just been made redundant so it was just a case of saying "this really isn't a normal day".....so it would be interesting to see what the results would be....(If I had been more active)" (WB, M, 4)

Disruption of sleep and other activities

More than twice as many negative than positive comments were made regarding ambulatory monitoring. A key issue here was disruption to sleep and other activities due to discomfort. Such views were held regardless of ethnicity.

"I didn't get much sleep (on the day of the ABPM) because as soon as it started it woke me up" (AC, F, 3)

Embarrassment, medicalisation and anxiety

The fact that monitoring occurred throughout the day and was obvious to others, hence resulting in potential embarrassment, were particular issues reported by South Asian and African-Caribbean participants:

"if the design was a bit more discreet and a little bit more user friendly then maybe we would have had a different experience but as it stands now you know, it is intrusive"
(SA, M, 4)

".....what I did mind was walking along the road and then I would get the warning and have to stop.....and people were watching me.....and it was so embarrassing" (AC,F, 6)

Both ethnic minority groups commented on the anxiety that ambulatory monitoring brought on and the impression given to others of having a medical problem:

"'cos I live with my in-laws I had to hide it from them 'cos I didn't want them to get worried that there was something wrong" (SA, F, 5)

Discussion

Summary

This study has evaluated acceptability data from a large group of people drawn from white British and two major ethnic minority groups and has shown that whilst all methods of blood pressure monitoring were broadly acceptable to people from all three ethnic groups, ambulatory monitoring was less favoured. Furthermore, South Asian and African Caribbean participants found all types of monitoring significantly less acceptable than those from the white British group and, this was reflected in lower completion rates, particularly for the South Asian group. Given UK and international guidelines on the use of ambulatory

monitoring for the diagnosis of hypertension, a 20% difference in completion of such monitoring could have a significant impact on the quality of care across ethnic communities.^{6 25} Conversely, self-monitoring proved popular with all participants. The consistency of results across quantitative and qualitative methodologies suggests that genuine differences exist in acceptability between methods and between ethnic groups.

Strengths and Limitations

To our knowledge, this is the first study to gain detailed information on the acceptability and performance of different methods of blood pressure monitoring in a large multi-ethnic population. This is important because such monitoring is such a common aspect of clinical management, particularly in primary care. The results are strengthened by using a combination of methods.

Participants were recruited from one area of the UK and homogeneity within ethnic groups has been assumed. This might potentially limit generalisability in that there may be differences within the ethnic categories used in this study. However, the uniformity of responses from multiple methods by those of different ethnic groups suggests that this is unlikely to have affected the headline results.

Recruitment relied on purposive sampling of a pool of volunteers to ensure that all three minority ethnic groups were represented and as were those with and without a diagnosis of hypertension. Respondents from ethnic minority groups were younger and this was taken into account in the statistical analysis.²⁶ More participants had a previous diagnosis of hypertension than not, although this might be expected to lead to better rather than worse acceptability given prior exposure.

Comparison with existing literature

In common with previous studies, this work has shown that ambulatory monitoring is less acceptable than other methods of blood pressure measurement.¹¹⁻¹³ Compared to the previous work in the UK, Greece and in a largely white area of the US, the current study has extended these findings to African Caribbean and South Asian groups. To our knowledge,

the reduced acceptability of ambulatory monitoring by minority ethnic groups, and particularly South Asians has not been reported before.

Whilst relative preferences for modality of blood pressure monitoring were broadly consistent between ethnic groups, South Asian and African Caribbean participants rated all modalities of blood pressure monitoring less favourably than their white British counterparts albeit only approaching significance for the South Asian group for ABPM. This fits with data suggesting that minority ethnic groups rate various aspects of primary care less favourably than white British.²⁷

Respondents considered ABPM was acceptable when there was a clear medical need, as it resulted in improved accuracy, reinforcing findings from the US and Greece.^{12 13} The most commonly reported issue with ABPM in the focus groups and questionnaire responses was disturbance of sleep: hence, use of daytime ambulatory monitoring alone might improve this.

The positive views on home monitoring expressed here reinforce similar findings from recent trials.^{28 29} However, this method has been shown to have only moderate diagnostic agreement when tested against the reference of ABPM.² Nonetheless, longitudinal studies have shown improved prognostic power from home compared to clinic readings and recent Japanese guidelines have incorporated self-monitoring for both diagnosis and ongoing management.^{30 31}

Implications for Practice

Around 20% fewer South Asian individuals completed the minimum acceptable number of ambulatory measurements compared with white British people, despite multilingual research team, availability of translated research materials and probably longer explanations than might occur in daily practice. This seems from the Focus Groups to have been at least in part because of issues of embarrassment compounded by questions from extended family that may be more relevant to minority ethnic groups. Serious consideration as to how this problem can be addressed is needed if the benefits of accurate monitoring and particularly diagnosis are to be extended to all. An important issue is the current often bulky and noisy ambulatory monitoring technology. New methods of indirect blood pressure

monitoring which do not require inflating cuffs are under development and may address this.³²

Greater use of home monitoring in the management of hypertension seems likely to be supported by people of all ethnicities. In the meantime, clinic monitoring currently retains a significant role in the management of hypertension despite its inaccuracy.^{5 25} Clinicians' decisions regarding method of blood pressure monitoring for an individual should take into account both clinical need and patient preference: however a discussion of lifestyle and cultural factors, particularly with those from minority ethnic groups, may be required in order to maximise the quality of care provided.³³ In blood pressure monitoring, ethnicity is relevant.

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Ethics

A favourable ethical opinion was obtained from the Birmingham and Black Country Ethics committee reference 09/H1202/114.

Contributorship

RJM and UM had the original idea for this work and gained funding in collaboration with PG, JM, SG, JC and MM. GH, AJ, CS and SW collected the data in collaboration with colleagues in the PCRN-CE. SW, SG, RJM, SH and MM did the analyses. SW, RJM and SG wrote the first draft of this paper and all authors subsequently assisted in redrafting and have approved the final version. RJM will act as guarantor and affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned have been explained.

Competing Interests

RJM has received research support in terms of blood pressure monitors from Omron and Lloyds Pharmacies and funding to attend and speak at the Japanese Society of Hypertension. All authors have completed the Unified Competing Interests Statement.

Data Sharing

Requests for data sharing to the corresponding author.

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Appendix eTable 1

	Clinic				ABPM				Home			
	All (n=769)	White British (n=300)	South Asian (n=240)	African- Caribbean (n=229)	All (n=715)	White British (n=292)	South Asian (n=213)	African- Caribbean (n=210)	All (n=727)	White British (n=293)	South Asian (n=223)	African- Caribbean (n=211)
	Med (IQR)	Med (IQR)	Med (IQR)	Med (IQR)	Med (IQR)	Med (IQR)	Med (IQR)	Med (IQR)	Med (IQR)	Med (IQR)	Med (IQR)	Med (IQR)
It made me anxious	2 (1 - 5)	2 (1 - 3)	2 (1 - 4.5)	2 (2 - 5)	2 (1 - 5)	2 (1 - 3)	2 (1 - 5)	2 (2 - 5)	2 (1 - 2)	2 (1 - 2)	2 (1 - 5)	2 (1 - 5)
It disturbed activities	2 (1 - 3)	2 (1 - 3)	2 (1 - 4)	2 (1 - 2)	5* (2 - 6)	5* (2 - 6)	5* (2 - 6)	5* (2 - 6)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)
It disturbed sleep	2 (1 - 4)	2 (1 - 4)	2 (1 - 4)	2 (1 - 4)	3* (2 - 6)	3* (2 - 6)	5* (2 - 7)	2 (2 - 6)	2 (1 - 2)	2 (1 - 2)	1 (1 - 2)	2 (1 - 2)
It disturbed work	2 (1 - 4)	2 (2 - 4)	2 (1 - 4)	2 (2 - 4)	4* (2 - 6)	4* (2 - 5)	4* (2 - 6)	3 (2 - 6)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)
It was uncomfortable	2 (1 - 4)	2 (1 - 5)	2 (1 - 5)	2 (1 - 2)	5* (2 - 6)	5* (2 - 5)	5* (2 - 6)	5* (2 - 6)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)
I felt self conscious	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (2 - 5)	2 (2 - 5)	2 (2 - 3)	2 (2 - 6)	2 (2 - 6)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 3)
I was unsure what to do	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	1 (1 - 2)	2 (1 - 2)
There was a lot of waiting around	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 3)	2 (2 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)
It worried me, knowing the blood pressure	2 (1 - 3)	2 (1 - 2)	2 (1 - 5)	2 (2 - 5)	2 (1 - 3)	2 (1 - 2)	2 (1 - 4)	2 (2 - 3)	2 (1 - 5)	2 (1 - 3)	2 (1 - 5)	2 (2 - 5)
It was difficult to remember to do it	2 (2 - 4)	3 (2 - 4)	2 (1 - 4)	2 (2 - 4)	2 (1 - 4)	2 (1 - 4)	2 (1 - 4)	2 (2 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 5)	2 (1 - 3)
It is accurate \$	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)
I felt in control \$	2 (1 - 2)	2 (1 - 2)	2 (1 - 3)	2 (2 - 4)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 3)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)
It is a good use of Dr or nurse time \$	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)	2 (1 - 2)
Adjusted Mean Acceptability Score (95% CI)	2.4 (2.3-2.4)	2.2 (2.1-2.4)	2.4 (2.3-2.6)	2.5 (2.4-2.6)	2.9 (2.8-3.0)	2.7 (2.6-2.9)	3.1 (3.0-3.2)	3.0 (2.8-3.1)	2.1 (2.0-2.2)	1.9 (1.8-2.1)	2.2 (2.1-2.4)	2.3 (2.1-2.4)
Adjusted Median (IQR) Acceptability Score	2.3 (2.1-2.7)	2.3 (2.0-2.5)	2.3 (2.0-2.7)	2.5 (2.1-2.8)	2.9 (2.6-3.2)	2.8 (2.6-3.0)	3.0 (2.7-3.4)	3.0 (2.6-3.2)	2.1 (1.8-2.4)	2.0 (1.8-2.2)	2.1 (1.8-2.5)	2.3 (1.9-2.6)

* Significant difference at p=0.05 for these items vs other methods of measurement

Each statement rated via 7 point likert scale. Ratings: 1=disagree strongly; 2=disagree; 3=disagree slightly; 4=unsure or not applicable; 5=agree slightly; 6=agree; 7=agree strongly.

\$ Scoring reversed for positive items (accurate, control, good use of time) ie 1=agree strongly, 7 disagree strongly.

Acceptability score is mean of all 13 individual questions

Appendix eTable 2 Focus Group Characteristics

	White British		South Asian		African Caribbean	
	Male	Female	Male	Female	Male	Female
Order	2	1	5	6	4	3
Number of participants	4	7	6	5	8	7
Age (median, range)	71 (50-72)	67 (64-73)	63 (52-72)	46 (41-55)	55 (47-72)	64 (63-72)
Years in UK (median, range)	71 (50-72)	67 (64-73)	44 (28-48)	38 (25-41)	46 (5-52)	47 (44-48)
Hypertensive (n, %)	2 (50)	4 (57)	4 (67)	2 (40)	5 (63)	7 (100)

Topic Prompts for Focus Groups

Office Measurements

- How did you find the experience of having your blood pressure measured in the clinic?
- How did this process make you feel?
- Do you think that having your blood pressure taken at the clinic is an accurate way of measuring it?
- How convenient is it for you to have your blood pressure measured at the clinic?

Home Monitoring

- Prior to this study, had any of you taken your blood pressure with a home monitor? If so, had you had any training on this?
- How was the experience of home monitoring in this study for you?
- How did knowing the readings make you feel (particularly if they were either high or low)?
- How easy was it to monitor your blood pressure at home? Which factors may have made it more difficult (e.g. machine problems, fitting this in with normal daily routines?)
- Following this experience, are you interested in continuing to monitor your blood pressure at home? Would you consider buying your own machine? Why/not? How would you feel about passing these readings on to your GP?
- Would you be prepared to measure your blood pressure at home if it meant that you didn't need to have your blood pressure measured at the GP surgery?
- Do you think that the readings obtained through home monitoring will affect the way that your GP manages your blood pressure? If so, how?

Ambulatory Monitoring

- How was the experience of wearing the ambulatory cuff for 24 hours (what did you like/not like)?
- What impact did it have on your daily activities e.g. washing/driving/work/sleep or personal relationships? As a result, did you take the cuff off at all?
- Did you experience any technical problems (e.g. with the machine)?
- Would you be prepared to have wear the cuff for 24 hours once a year, if it meant that you didn't need to have your blood pressure measured at the GP surgery?
- Do you think that the readings obtained through ambulatory monitoring will affect the way that your GP manages your blood pressure? If so, how?

Results

Introductory statement that all results are confidential and that there is no need to discuss further if the patient isn't comfortable

- How did you feel about getting your results?
- If there was any significant difference between methods, why do you think that was?
- Was this information useful to you? Were the results what you were expecting?
- Has this led to any changes in the way that your blood pressure is managed?

Concluding

- Of the three methods that were trialled which would you prefer to use in the future? Why?
- Which method would you least like to use in the future? Why?
- Is there anything else that you'd like to tell us?

Blood pressure in different ethnic groups (BP-Eth): a mixed methods study

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ABSTRACT

Introduction: People of South Asian, African-Caribbean and Irish ethnicity are known to have worse cardiovascular outcomes than those from the white British group. While the reasons underpinning this are complex, the effect of hypertension is both significant and modifiable. In recent years, there has been increasing interest in and uptake of 'out-of-office' methods for blood pressure (BP) monitoring. However, guidance in this area has been largely based on research among the white population. This study aims to answer the following questions: (1) How often and in what ways does blood pressure (BP) monitoring occur and how does this differ between white and the above minority ethnic populations. (2) Are the thresholds for diagnosis of hypertension, and treatment targets in hypertension comparable for white British and minority ethnic populations using different measurement modalities: office blood pressure, ambulatory BP monitoring and home monitoring? (3) What preferences for BP measurement do people from white and minority ethnic populations have?

Methods and analysis: A mixed methods approach will be used including the following: (1) A postal survey sent to 8000 hypertensive and not-known-to-be-hypertensive people from all four ethnic groups will determine current patterns of BP monitoring. (2) A validation study will compare BP measurement by ambulatory monitoring with office standard measurement, office research measurement and home monitoring in 200 people from each of the ethnic groups concerned. (3) Focus groups organised by ethnicity and gender will gather qualitative data regarding patient preferences for and experiences of BP measurement in each of the given modalities.

The data collected from these phases will be analysed appropriately in order to answer the above research questions.

Ethics and dissemination: Ethical approval has been gained from the Black Country Research Ethics Committee: Ref 09/H1202/114. The results of this work will be disseminated via journal publication and conference presentation.

INTRODUCTION

Cardiovascular outcomes for people of South Asian, African-Caribbean and white Irish origin living in the UK are worse than those

ARTICLE SUMMARY

Article focus

- The blood pressure in different ethnic groups (BP-Eth) study will provide important new evidence regarding the comparability of the thresholds for diagnosis of hypertension and monitoring in hypertension between white and minority ethnic groups using different modalities of measurement.
- It will also provide useful information about current patterns of and preferences for BP monitoring by ethnicity.

Strengths and limitations of this study

- The BP-Eth study is the first to directly compare BPs between ethnic groups using different modalities of measurement. The sample size of 800 for the validation study is sufficient to detect a 5 mm Hg difference in mean BP by ethnic group between measurement modalities. Furthermore, the postal survey of 8000 people will provide robust evidence regarding current patterns of BP monitoring in different ethnic groups, while the focus groups will enable the factors determining patient preferences for different modalities of BP measurement to be better understood. The ethnic comparison aspect of the study may be limited if it is not possible to recruit a sufficient number of participants from each ethnic group under consideration to the various phases.

Key messages

- The BP-Eth study will consider the accuracy and acceptability of home, ABPM and clinic readings in minority ethnic populations in relation to the white British group. It will then assess whether current diagnostic thresholds and treatment targets for different modalities of measurement are appropriate in these ethnic groups.

for the white British group.^{1 2} For example, South Asians have a 40–50% greater risk of mortality from coronary heart disease (CHD) compared with the general population^{3 4} with evidence that the poorest groups of Pakistanis and Bangladeshis have the highest death rates.^{2 5 6} The mortality of migrant Caribbeans from CHD is lower than the

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national average but stroke deaths are higher (in women by 57%, men 24%), with hypertension (HT) being the major associated risk factor.² Furthermore, data available suggest that the mortality of UK-born Caribbeans is little better than for those who have migrated from their homeland.⁷ Similarly, the Irish living in Britain experience higher mortality from both CHD (in women by 20%, men 24%) and strokes (in women by 23%, men by 38%).⁸ Little is known about CHD and stroke mortality among UK-born Irish people, but one study reported an increase of 51% in cardiovascular mortality for men with Irish names living in Scotland.⁹

This increase in cardiovascular risk in ethnic groups is probably due to an interplay of complex factors including genetics, lifestyle (ie smoking habits, diet, barriers to healthcare) and deprivation.⁷ Hypertension remains a significant and potentially treatable risk factor in all ethnic groups. For example, in a Bangladeshi population with type 2 diabetes one study found a prevalence of 23.2% for systolic hypertension.¹⁰ There is also evidence that hypertension may go undetected and under treated in minority ethnic groups. Cappuccio *et al* found a twofold to threefold increase in hypertension in South Asians and Caribbeans; only 49% of those with hypertension had adequate control; 18% were undiagnosed before the survey and 17% were not receiving medication.¹¹

Blood pressure monitoring

Increased availability of various automated devices has encouraged individuals to monitor their blood pressure at home. The use of ambulatory blood pressure monitoring (ABPM) has also led to a realisation that multiple readings may improve accuracy of diagnosis. In general, both ABPM and home monitoring may help to improve treatment,^{12–13} identify resistant HT,¹⁴ diagnose white coat HT^{15–17} and predict cardiovascular outcomes.^{18–20} ABPM is the only method that can identify reduced night time dipping which is a poor prognostic indicator.²¹ The definitive diagnosis of white-coat HT by means of ABPM may ultimately improve health outcomes and reduce healthcare costs.²⁰

Few studies of blood pressure monitoring undertaken over the last 20 years have included people from South Asian, African-Caribbean or white Irish populations with the result that very little is known about comparative measurements including self-monitoring. For instance, it is not clear as to whether the 'white coat' effect seen in white British populations is similar, greater or less among these minority ethnic communities. Nor is it known whether observed differences between office and home measurements among the white group are similar or different in South Asian or African-Caribbean populations.

Diagnosis and management of blood pressure

The diagnosis and management of blood pressure are informed by guidelines largely based on research from white populations.^{10–22} These guidelines recommend diagnostic and treatment thresholds for hypertension on

the basis of office blood pressure and 24 h ABPM or home blood pressure monitoring. Indeed, the recent NICE guidance for the management of hypertension¹⁰ uses factors to adjust between clinic and 'out-of-office' thresholds for diagnosis that were derived from Australian data gathered in a population that was 82% white and 15% Asian.²³ These factors are a decrease of 5/5 mm Hg when converting from clinic to out-of-office measured blood pressures at lower levels (stage 1 threshold) and a corresponding decrease of 10/5 mm Hg at higher levels (stage 2 threshold). At present, ethnicity is not considered in the specification of these thresholds, treatment targets or adjustment factors.

Purpose

The BP-Eth study will consider the accuracy and acceptability of home, ABPM and clinic readings in minority ethnic populations in relation to the white British group. It will then assess whether current diagnostic thresholds and treatment targets for different modalities of measurement are appropriate in these ethnic groups.

METHODS

Overview of methods

BP-Eth is a primary care-based mixed methods observational study involving both quantitative and qualitative elements.

Study has three phases

Phase 1—postal cross-sectional survey

Phase 2—validation study

Phase 3—focus group study

Population

The study population will comprise people both with and without diagnosed hypertension recruited from primary care. Eligibility criteria will be aged between 40 and 74 years and belonging to one of the four ethnic groups under investigation (white British, white Irish, South Asian, African-Caribbean). Patients who are unable to consent to participation belong to a different ethnic group or who's general practitioner feels they are unable to take part will be excluded. Participants will need to have had at least one blood pressure recorded in their electronic medical records within the last 5 years.

Setting

Patients will be identified from practices who are members of the Central England Primary Care Research Network (PCRN-CE). This includes around 300 practices in the West Midlands which have been shown to be generalisable to wider primary care.²⁴ Approximately 20 practices will be recruited to participate in this study.

Phase 1 postal cross-sectional survey

Procedures

A cross-sectional survey of 8000 people including representative samples of both HT and not known to be hypertensive (NHT) individuals from the four ethnic groups under consideration will elucidate current blood pressure monitoring patterns (self, third party, eg, pharmacy, etc, health professional), confirm ethnic group and identify participants for the validation study. This postal questionnaire will be sent to approximately 4000 people with a Read Code of hypertension in their electronic medical notes and 4000 with no such Read Code. A list of eligible participants from each practice will be generated from the criteria specified above. An equal number of participants with and without hypertension will be randomly selected to receive the survey. Practices will be chosen from areas likely to include appropriate populations based on ward-level census data and personal knowledge of the investigators. The survey questionnaire will be accompanied by a covering letter translated into the relevant languages, with telephone follow-up of non-responders by a bilingual researcher. Responses will be entered into a secure database.

Outcome measures

The primary outcome measure will be prevalence of self, professional (practice, pharmacy and outpatient) and ambulatory monitoring over the last 12 months in each ethnic group. Secondary outcomes will include preferences for different types of monitoring.

Sample size considerations

Phase 1 questionnaires will be sent to a random sample of 8000 people (see above). A 50% response rate (realistic in this population from previous work) would result in 4000 responses. It is anticipated that a proportion of responses will fall outside of the four ethnic groups being studied; hence further questionnaires will be sent as required (up to 10 000) in order to receive responses from 1000 individuals in each ethnic group under consideration, half of which will have hypertension and half will not. This will allow estimation of the overall prevalence of the different types of monitoring with and without hypertension to within 2.7% assuming a 10% prevalence of monitoring in each case (the approximate community prevalence of self-monitoring in a white population).²⁵

Analysis

The overall prevalence of blood pressure monitoring will first be estimated. Thereafter, the variation in its prevalence by ethnic group, age, sex, employment status and deprivation will be explored using logistic regression models which may also incorporate a random effects term for general practices.

Phase 2 validation study

Procedures

Phase 2 is a validation study comparing blood pressure monitored in a clinic setting with ambulatory and home measurements. Participants in this phase will be asked to measure their blood pressure using all three of these methods. Recruitment will be from those responding to phase 1 who indicate a willingness to participate in phase 2. Such individuals will then be invited to attend clinics run at their own practices. Blood pressure measurements and study questionnaires will be undertaken along with training regarding both ambulatory and home monitoring. [Figure 1](#) shows how patients move through the various different methods included in this phase while [table 1](#) shows the data that will be collected as a result. The order of out-of-office blood pressure measurement (home or ambulatory) will be randomised so that approximately equal numbers of individuals will have home or ambulatory first. People with and without hypertension will be invited to undertake phase 2 so that approximately equal proportions of each are included. Upon completion of this phase, participants will be asked whether they would be willing to take part in phase 3.

Outcome measures

The primary outcome will be the mean difference between the reference standard (mean daytime ambulatory blood pressure) and standard office (mean of second and third readings on three occasions), mean home monitored BP (last 24 readings), office research (mean of second to sixth readings on three occasions) and the last routine practice blood pressure recorded in the clinical records. Each different ethnic group will be considered separately with subgroups of those treated for hypertension and not receiving treatment. The effect of these differences on standard diagnostic and treatment target thresholds will be evaluated (ie 140/90 mm Hg for clinic readings and 135/85 mm Hg for out of office measurement at the stage 1 threshold and the equivalents at the stage 2 threshold).¹¹

Sample size considerations

About 100 patients with and without hypertension will be recruited from each ethnic group. On the basis of previous work in a white population, 200 patients per ethnic group, that is, 800 people in total, will be sufficient to detect a difference of 5 mm Hg in mean differences between any two populations (this is sufficient across the plausible range of SDs between 12 and 18 mm Hg, power 80%). Differences of less than 5 mm Hg are unlikely to be clinically significant given the day-to-day variation of blood pressure within individuals. A further 5% approximately will be recruited as required to account for drop-outs or equipment malfunction.

Blood pressure in different ethnic groups

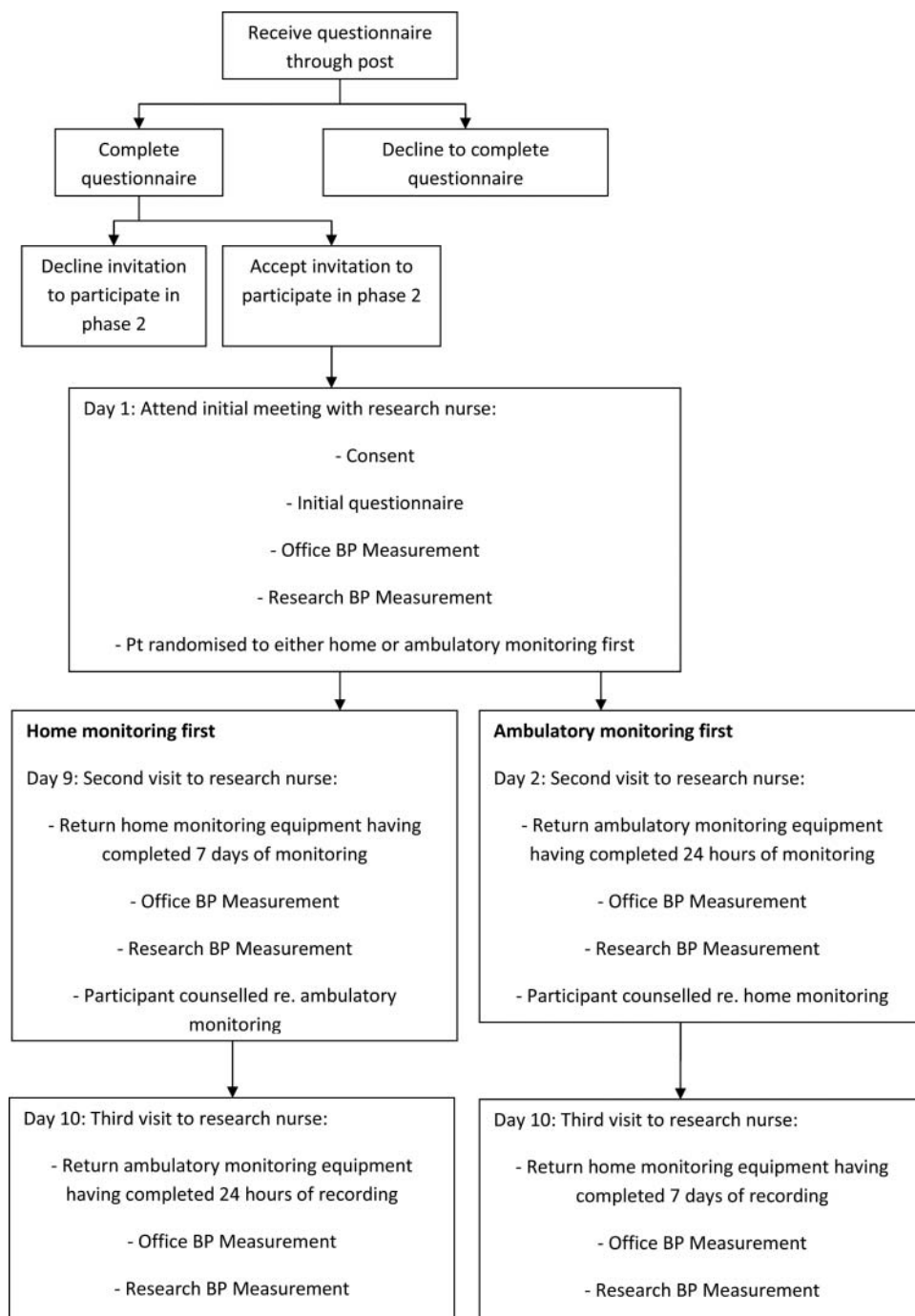


Figure 1 Patient flow through phase 2.

Analysis

Between groups, *t* tests will be used to compare mean differences in ambulatory versus office, home-monitored and routine blood pressures between white British, South Asian, African-Caribbean, white Irish populations separately for people with a diagnosis of hypertension, and for people without a prior diagnosis of hypertension (ambulatory used as reference standard). Since we are interested in the differences between each minority ethnic group and the white British group, each

comparison is of interest and will be dealt with individually. Thus, no adjustment for multiple comparisons is required. Within groups, repeated measures general linear modelling (GLM) and mixed effects models will be used to evaluate differences between the different methods of measurement and routinely collected BP data with post hoc tests where significant differences are found. Baseline covariates will be examined for similar age/gender/blood pressure distribution and adjustment will be incorporated in the analysis where necessary.

Table 1 Summary of data collected during phase 2

Questionnaires	Demographic details
	Medical history Antihypertensive and other relevant medication Smoking status and alcohol consumption Ethnicity Place of birth Years residence in UK Spoken languages (first and any others) Religion Marital status and highest educational qualification Beliefs about medicines questionnaire—as per that used by Home <i>et al</i> ⁸² Blood pressure monitoring acceptability questionnaire (for each of the three types of monitoring)—as per that used by Little <i>et al</i> ⁸³ Blood pressure monitoring preference questionnaire
Physical measurements	Height Weight Waist circumference
Blood pressure measurements	Clinic blood pressure using BP-Tru Sphygmomanometer measured on three occasions with bilateral simultaneous measurement on the first occasion Ambulatory blood pressure measurement over 24 h with half hourly measurement 8:00–23:00 and hourly measurement 23:00–8:00 Home blood pressure measurement, two readings twice daily for 7 days, that is, 28 readings total

Differences will be investigated to assess any relationship to the level of blood pressure. A significance level of $p < 0.05$ will be used and sensitivity analysis will examine the potential effect of missing data. Analyses will be performed at the end of the study after all data have been collected. No interim analysis will be performed as this is an observational study. Planned subgroup analyses will be undertaken for diabetic versus non-diabetic patients, older versus younger (65 as threshold), males versus females, higher versus lower blood pressure (threshold 150 systolic).

Phase 3 focus group study

Procedures

Focus groups comprising participants who have completed phases 1 and 2 will consider patient preferences for and experiences of blood pressure measurement in each of the three ways included in the study. Eight groups will be organised according to gender and ethnicity. The former is necessary in order to achieve the research objectives. Meanwhile, it is well known that males and females may interact differently in mixed-gender as opposed to same-gender groups.²⁶ It is therefore anticipated that organising by gender will enabled a more liberal exchange of views across all ethnicities. It is also hoped that each group will comprise an adequate mix of HT and NHT patients. However, given the difficulties of gathering the requisite number of participants (see below) with the same gender and ethnicity at a given time and location, recruitment will

be independent of hypertensive status. While each group will be held at a participating practice, participants may be drawn from many different practices: however, they will all have finished phase 2 within the last 6 months (any longer than this may result in recall issues). Each group will be facilitated by a researcher according to a topic guide which will comprise a predetermined set of questions developed by the study steering group. Each session will be recorded, while a co-researcher will also attend to make a note of the opening words used by each participant in order to enable identification later on. Interviews will be transcribed verbatim for analysis. It is envisaged that each focus group will be conducted in English. However, if it emerges that the South Asian participants agreeing to attend the group would like to converse in an alternative language then this will be arranged through the recruitment of a facilitator with the appropriate linguistic skills, and subsequent translation of the corresponding transcript back into English.

Outcome measures

This phase of the study will explore preferences for and acceptability of different modalities of blood pressure measurement by ethnic group.

Sample size considerations

Eight focus groups will be organised, as mentioned above, to ethnicity and gender. Research suggests an optimal focus group size of between 5 and 10

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participants.²⁷ The proposed group size here is between 6 and 8 individuals in order to capture a variety of views in response to each question on the topic guide within a 1.5 h time frame. Given likely attrition rates of around 20%,²⁸ 10 participants will be recruited to each of the focus groups in order to achieve the target size.

Analysis

A 'thematic' approach will be used in the analysis of the focus group transcripts. This is ideally suited to identifying the ideas and relationships that underpin preferences for each modality of BP.²⁹ Here, textual data in transcripts will be grouped into meaningful categories ('themes') in order to represent a range of attitudes and ideas along with otherwise unarticulated social values.³⁰ As new transcripts are produced for later focus groups the themes may be revised. Each coded transcript will then be passed to a second researcher for triangulation purposes. The purpose of the analysis is to compare themes within, between and across ethnicities: a matrix will be constructed in order to facilitate this. Patterns and trends will then be identified and their basis will be considered. Where relevant, the interaction between participants will be analysed in order to ascertain how knowledge is constructed within the group setting. Here, an analytical template proposed by Lehoux *et al*³¹ will be used.

Recruitment

Twenty practices with mean list sizes of 5000 adult patients (lower than usual list sizes to reflect the typical practice sizes seen in majority ethnic population areas such as the inner city) and a conservative prevalence of hypertension of 10% will result in a potential sample of at least 10 000 patients with hypertension and many times this number without. This will be sufficient for the invitations needed for phase 1 and respondents will subsequently be recruited into phases 2 and 3. Further practices may be required later on to ensure an adequate mix of ethnicities.

Staff training

All staff involved in the study will undergo training given by the lead research nurse in order to ensure a consistent approach. Work instructions detailing the procedures to be followed in each of the different phases will be made available. These will describe the action to be taken in the instance of unusually high or low readings, a significant inter-arm difference and severe bruising/allergy from use of a blood pressure cuff.

Ethics and dissemination

Ethical approval has been gained from the Black Country Research Ethics Committee: Ref 09/H1202/114. The results of this work will be disseminated via journal publication, conference presentation and feedback to participating practices.

DISCUSSION

The results of this study will be relevant to UK primary care as information about norms and preferences for ambulatory and self-monitoring in minority ethnic groups is vital to allow optimum care to be provided both in the diagnosis and in the management of hypertension. Determining the relationship between home/ambulatory blood pressure monitoring and standard office readings in each ethnic group will allow consideration to be made of whether the current thresholds for diagnosis of hypertension, and treatment targets in hypertension, are universally appropriate. Furthermore, it will also enable adjustment factors between different methods of blood pressure measurement to be derived for each ethnic group.

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Competing interests None.

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